

Original Research Article

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## Disease Incidence and Symptoms of White Rot of Onion caused by *Sclerotium rolfsii* in Manipur

Rimamay Konjengbam\*, Rajkumari Tombisana Devi and Naorem Iboton Singh

Central Agricultural University, Imphal, Manipur, India

\*Corresponding author

### ABSTRACT

#### Keywords

Onion, White rot, *Sclerotium rolfsii*, Disease incidence, Sclerotia

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Onion (*Allium cepa* L.) is an important vegetable and spice crop in Manipur. White rot of onion caused by *Sclerotium rolfsii* is found in destructive condition at onion growing locations in the valley districts of Manipur. The highest disease incidence was recorded in Imphal West district with maximum disease incidence being recorded from Malom. The lowest disease incidence was observed in Imphal East district with minimum disease incidence being recorded from Pukhao. The maximum disease incidence was observed during the month of April and the minimum disease incidence was observed in February in all the districts. The symptoms of white rot were not obvious during the first three months after planting. It became prominent in the month of February with yellowing of leaves followed by wilting as the disease progresses and most prominent at April when the base of onion stem starts rotting and eventually become covered with white cottony mycelial growth of the fungus in the presence of sclerotia. When such plants are uprooted, the roots, base plate, bulb scales and sometimes, the entire bulbs are decayed and watery.

### Introduction

Onion (*Allium cepa* L.) is used both as vegetable and spice in Manipur. Both the leaves and bulb are used either raw or cooked. Onion is referred to as queen of the kitchen (Selvaraj, 1976). Onion is well known for its pungency. The pungency is due to volatile oil known as allyl propyl disulphide. Onion is rich in phenolics and flavonoids compounds that are well known to be anti-inflammatory, anti-cholesterol, anti-carcinogenic, antiproliferative, and antioxidant properties (Williamson *et al.*, 1997; Yang *et al.*, 2004; Michael and Smith, 2005). In Manipur, onion

is cultivated mostly as a cool season crop. Onion is known to suffer from various diseases and insect pests (Mishra *et al.*, 2014). White rot of onion is one of the important diseases and it has wrecked onion cultivation in Manipur in the recent years. White rot of onion caused by *Sclerotium cepivorum* Berk. was first reported in Oregon in 1918 and in Virginia in 1923 and the disease was studied thoroughly in England (Walker, 1924). In Manipur, white rot of onion is caused by *Sclerotium rolfsii* Saccardo. The fungus is polyphagous and infects a large number of both monocotyledonous and dicotyledonous crops (Aycock, 1966; Mordue, 1974; Punja,

1985). The fungus has a broad host range and causes southern blight on several plants. Initial stages of infection are constricted to the host root system and the fungus spread from plant to plant through root contact (Scott, 1956).

In Manipur, the detailed information about the disease is not available at present. Therefore, the research investigations were carried out to study the incidence of white rot in the valley districts of Manipur along with symptoms of the disease.

## **Materials and Methods**

The research investigation was conducted at the Department of Plant Pathology, College of Agriculture, Central Agricultural University, Imphal during 2015-2016.

### **Survey for white rot disease incidence of onion at different locations in the valley districts of Manipur**

Surveys were conducted during the crop season February to April in 2015-2016 for white rot of onion at different commercial onion growing locations in the valley districts of Manipur namely Imphal East, Imphal West, Thoubal and Bishnupur.

Observations on the disease incidence were taken by selecting 200 plants randomly from the farmers' field and were converted to disease incidence as follows:

$$\text{Percent disease incidence} = \frac{\text{Total number of diseased plants}}{\text{Total number of healthy plants}} \times 100$$

### **Collection of the diseased samples and isolation of causal pathogen involved**

The diseased bulbs were collected from surveyed areas. The infected bulb scales were cut into small pieces of 2-3mm size. These

pieces were surface sterilized with 1% sodium hypochloride solution. The sterilized pieces were blot dried then inoculated on potato dextrose agar medium and were incubated at  $28 \pm 1^\circ\text{C}$  for 4 days. Daily observations were taken on the development of the pathogens. The causal pathogen was purified by hyphal tip cut method and re-isolated on potato dextrose agar medium. Culture was maintained on freshly prepared potato dextrose agar medium and periodically sub cultured to fresh medium throughout the research period.

### **Pathogenicity test of the isolated pathogen**

Pathogenicity test was done by transplanting 45 days old onion seedlings in artificially inoculated soil on plastic pots. Field soil was collected and sterilized at 15 lb/in<sup>2</sup> for 2 hours consecutively for 3 days. Plastic pots were filled up with 250 grams of sterilized soil. 10 sclerotia (10 days old) were mixed with the soil and kept for 15 days. 45 days old onion seedlings were then transplanted. The seedlings were observed for typical symptoms of yellowing and wilting of leaves. Seedlings showing the characteristic symptoms were uprooted. The pathogen was re-isolated from diseased bulb scales to confirm the pathogenicity of the fungus. The pathogen was compared with relevant monographs.

### **Detail observations of disease symptoms**

Symptoms of onion white rot were observed from seedling until maturity of the plant.

## **Results and Discussion**

### **Survey for white rot disease intensity of onion at different locations in the valley districts of Manipur**

White rot of onion was found well distributed at various onion growing locations in the

valley districts of Manipur. The maximum disease incidence of 42.91, 52.42 and 65.58% was observed in Imphal West district and minimum disease incidence of 39.24, 49.17 and 59.24% in Imphal East during February, March and April respectively. The maximum disease incidence of 65.58, 59.24, 61.45 and 64.09% was found in April in all the districts of Imphal West, Imphal East, Thoubal and Bishnupur respectively. The highest disease incidence was recorded in Imphal West district during the crop season from Malom during February (46.40%), March (55.34%)

and April (67.42%) respectively. The lowest disease incidence was observed in Imphal East district from Pukhao during February (38.38%), March (48.12%) and April (56.40%) respectively. The disease incidence was less in February and March in all the districts. The disease was found to be more severe in April after the commencement of rains, therefore, indicating the influence of rainfall, higher relative humidity and lower temperature range of the soil on rapid disease development.

**Table.1** Disease incidence of white rot of onion in Imphal West district of Manipur

Name of Locality	Percent disease incidence			Mean
	February	March	April	
Moidangpok	43.00	51.02	65.65	<b>53.22</b>
Malom	46.40	55.34	67.42	<b>56.38</b>
Lamshang	38.00	54.00	62.90	<b>51.63</b>
Kodongpokpi	44.25	49.32	66.35	<b>53.30</b>
Mean	<b>42.91</b>	<b>52.42</b>	<b>65.58</b>	

**Table.2** Disease incidence of white rot of onion in Imphal East district of Manipur

Name of Locality	Percent disease incidence			Mean
	February	March	April	
Pukhao	38.34	48.12	56.40	<b>47.62</b>
Andro	40.62	49.34	61.16	<b>50.37</b>
Pangei	38.00	51.02	59.20	<b>49.40</b>
Khurai	40.00	48.20	60.20	<b>49.46</b>
Mean	<b>39.24</b>	<b>49.17</b>	<b>59.24</b>	

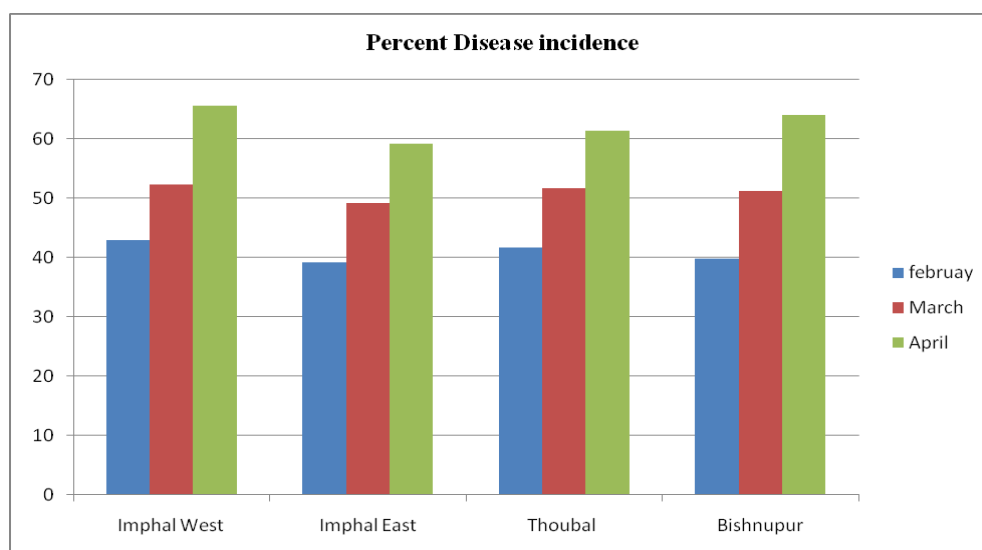
**Table.3** Disease incidence of white rot of onion in Thoubal district of Manipur

Name of Locality	Percent disease incidence			Mean
	February	March	April	
Wangjing	40.72	53.00	62.40	<b>52.04</b>
Lilong	39.75	50.32	59.05	<b>49.70</b>
Haoreibi	43.00	50.28	61.00	<b>51.42</b>
Uchiwa	43.48	53.35	63.35	<b>53.39</b>
Mean	<b>41.73</b>	<b>51.73</b>	<b>61.45</b>	

**Table.4** Disease incidence of white rot of onion in Bishnupur district of Manipur

Name of Locality	Percent disease incidence			Mean
	February	March	April	
Toubul khoijuman	42.52	54.32	66.50	<b>54.44</b>
Keinou	37.00	49.03	61.80	<b>49.27</b>
Oinam	39.90	49.34	62.55	<b>50.59</b>
Kabowakching	40.15	52.55	65.52	<b>52.74</b>
Mean	<b>39.89</b>	<b>51.31</b>	<b>64.09</b>	

**Fig.1** Disease intensity of white rot of onion in the surveyed areas of Manipur



**Fig.2** *Sclerotium rolfsii* Saccardo on potato dextrose agar



**Fig.3** Development of typical symptoms on pathogenicity test



**Fig.4** Infected bulb with white cottony mycelium at basal plate adjoining roots



**Fig.5** Yellowing and wilting of leaves



The disease progressed rapidly in April after rainfall. Walker (1924) reported that white rot of onion was most devastating in a moderately cool soil (15 to 18°C) having a medium moisture content after rainfall. The present findings are also in agreement with the findings of Amin *et al.*, (2014) who reported that the disease symptoms appear from mid season to harvest and he also stated the disease to be more destructive during the early spring.

### **Collection of the diseased samples and isolation of causal pathogen involved**

With repeated isolations of diseased samples collected from the surveyed areas, *Sclerotium rolfisii* Saccardo was consistently found to be associated with white rot of onion. The isolated fungus was purified and identified as *Sclerotium rolfisii* Saccardo on the basis of morphological characteristics and taxonomic keys available in the literature (Saccardo, 1913; Mordue, 1974).

### **Pathogenicity test of the isolated pathogen**

The onion seedlings with characteristic disease symptoms were observed after 7 days of transplanting as colonization of inner tissues of roots and stem base occur within 5-7 days of inoculation (Stewart *et al.*, 1989). The seedlings were also uprooted and exhibit characteristic symptoms of soft, watery decay accompanied by white mycelium and sclerotia. On re-isolation, the same fungus was consistently found to be associated with the disease. Hence, the pathogenicity of the fungus was proved. Mukherji and Tewari (1969) reported that *Allium cepa* suffered from white rot of onion caused by *Sclerotium rolfisii* in Lucknow. Mathur and Sharma (2002) also reported bulb rot of onion induced by *Sclerotium rolfisii* in Rajasthan. Kwon *et al.*, (2011) reported *Sclerotium* rot of onion caused by *Sclerotium rolfisii* in Korea.

### **Detail observations of disease symptoms**

The infected plants show yellowing and wilting of leaves. The tip of the leaves start drying from the tips backward, droop down and appear blighted (Walker, 1924; Kwon *et al.*, 2011; Amin *et al.*, 2014). At later stage of infection base of stem and leave sheath rots and collapsed (Stewart *et al.*, 1989). The plants gradually declined and collapsed (McLean and Stewart, 2000). Bulbs are decayed, watery, soft and are covered with white cottony mycelial growth of the fungus accompanied by the presence of small, circular, white, brown and black sclerotia interspersed among the mycelial growth and infected tissues (Walker, 1924; Amin *et al.*, 2014; Mishra *et al.*, 2014).

During investigations, it was observed that white rot also developed on harvested onion bulbs during storage. Therefore, further research work is considered very crucial.

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